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ABSTRACT

This book introduces journal-writing prompts in mathematics for Algebra I. Content prompts, attitudinal or affective prompts, and process prompts are presented. Each of the content prompts relates or connects topics within and outside of mathematics, targeting important or meaningful concepts and skills. The content prompts also provide situations that focus on areas in which students often have misunderstandings or misconceptions. Attitudinal or affective prompts focus on students' feelings about themselves as mathematicians and students of mathematics. The responses to the process prompts can give insight into students' preferences for problem-solving strategies and how they learn or remember. (KHR)

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The "Write" Way

Mathematics Journal Prompts

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FOR ALGEBRA I

Barbara J. Dougherty

A Publication of the University of Hawai'i's Curriculum Research & Development Group

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The "Write" Way: Mathematics Journal Prompts for Algebra I

The *Principles and Standards for School Mathematics* (National Council of Teachers of Mathematics, 2000) includes a separate standard for Communication for grades 6 through 8 and 9 through 12. This standard advocates using multiple activities that give students opportunities to demonstrate their understandings. These tasks should allow students to express themselves in a variety of ways such as with concrete models, pictures or drawings, or abstract symbols. Each of these forms lets students communicate with others about their thinking.

Communication should include at least five types of activities: (1) speaking, (2) reading, (3) listening, (4) modeling or constructing, and (5) writing. The last type can take the form of journal writing.

Journal writing can be structured to give you cohesive and comparable information about students and their thinking while you are challenging them through contextual situations. A structure for journal writing includes (1) mathematical content, (2) students' attitude or affect, and (3) processes.

Journal prompts give situations or questions to which students respond. Responses may include words, pictures or drawings, or symbols. Encourage students to support their ideas and to clearly explain what they mean. They can give specific examples as part of their explanations.

Content prompts relate or connect topics within and outside of mathematics, targeting important or meaningful concepts and skills. They can also provide situations that focus on areas where students often have misunderstandings or misconceptions. The responses to the prompts give teachers (and students) insight into how a student has interpreted a mathematical idea.

Attitudinal or affective prompts focus on students' feelings about themselves as mathematicians and students of mathematics. Students' responses allow you to assess how positive attitudes about mathematics and mathematicians are developing in the classroom environment.

Finally, being aware of how one solves or approaches problems is promoted by **process prompts.** The responses to these prompts can give insight into students' preferences for problem-solving strategies and into how they learn or remember. As students become aware of how they learn and solve problems, they grow stronger in confidence.

Introduction: Algebra

Description of materials

There are at least 100 prompts to choose from. Some of them may be used more than once to ascertain how students are growing in their understandings of and beliefs about mathematics. The prompts may also be used as assessment tasks for expanded response or self-constructed response items.

Each mathematical content prompt includes a short description of what you might expect or consider in students' responses. The mathematical content responses should reflect a student's progress in understanding the concept or skill.

The content prompts were selected to match recommendations from the National Council of Teachers of Mathematics *(Principles and Standards for School Mathematics,* 2000) rather than to fit a specific text. Locate the topic that you are studying and then select the prompt that best fits the class. You may change the wording if students will not understand the terminology or vocabulary used.

Affective or attitudinal prompt responses show students' beliefs. If you use them more than once, you should be able to detect changes in beliefs or feelings about mathematics as a discipline as the year or semester progresses.

Process prompts give students an opportunity to show how they do a mathematical process or algorithm (step-by-step procedure). When you use these prompts, you gain insight into how students have interpreted or altered procedures.

You can use writing prompts daily or intermittently, depending on your class, and you can repeat them from time to time. In prompts that use students' names, feel free to change the names to represent your students. If you use journal prompts daily, we recommend that students respond to three content prompts, one process prompt, and one attitudinal prompt in a week.

Evaluating students' responses

When we tested journal writing in classes, we found that students tend to give the writing more thought if it is to be scored. One method our writing team used was to score the responses on content rather than on grammar and spelling. We used an essay grading method, reading two or three papers to get a feel for students' responses. These first papers formed the baseline for scoring other papers.

We designed this rubric for scoring journal responses.

4 points: The student's work includes—
- a completed prompt or an answer to the question posed.
- support for statements made by using either examples or counterexamples.
- ideas clearly communicated to the reader.
- legible writing, drawings, pictures, charts or tables, and diagrams.
- accurate mathematics or information.

3 points: Omission of one criterion from level 4.

2 points: Omission of two criteria from level 4.

1 point: Omission of three criteria from level 4.

0 points: Omission of more than three criteria from level 4.

There are many ways to create a rubric. Teachers alone can develop a rubric, or students can work with the teacher to develop a rubric specific to their class. Here are two sample rubrics that have been developed with students' participation.

A five-level scale:

4 **The student's work shows a response that—**
- addresses the question raised in the prompt.
- has correct or accurate mathematics.
- is legible.
- has support or justification for any statements made.
- makes sense to the reader.

3 **The student's work shows a response that—**
- addresses the question raised in the prompt.
- has correct or accurate mathematics.
- is legible.
- does not have fully justified or supported statements.
- makes sense to the reader.

2 **The student's work shows a response that—**
- addresses the question raised in the prompt.
- has some incorrect or inaccurate mathematics.
- is legible.
- does not have justified or supported statements.
- is somewhat clear to the reader.

1 **The student's work shows a response that—**
- addresses the question raised in the prompt.
- has incorrect or inaccurate mathematics.
- is partially legible.
- does not have justified or supported statements.
- does not make sense to the reader.

0 **The student's work shows a response that—**
- does not address the question raised in the prompt.
- has incorrect or inaccurate mathematics.
- is not legible.
- does not make sense to the reader.

A three-point scale:

Exceeds standard The student's work shows a response that—
- addresses the question raised in the prompt.
- has correct or accurate mathematics.
- is legible.
- has support or justification for any statements made.
- makes sense to the reader.

Meets standard The student's work shows a response that—
- addresses the question raised in the prompt.
- has some correct or accurate mathematics.
- is legible.
- does not support or justify some of the statements made.
- makes sense to the reader.

Below standard The student's work shows a response that—
- does not address the question raised in the prompt.
- has incorrect or inaccurate mathematics.
- is not legible.
- does not support or justify statements made.

Although grammar and punctuation are not usually scored, students should communicate their ideas in ways that are understandable. Some students may use drawings, tables, charts, or other means to convey their ideas. They should be encouraged to use whatever way they need to make their ideas clear.

After the first writing assignment, you can take excerpts from students' papers to illustrate qualities that you consider important. Show comparisons between high- and low-quality responses by putting them on overhead transparencies or photocopying them for all students. Keep the responses anonymous.

Content Prompts: Algebra

You can present the prompt to the whole class and have students share ideas. You can record their ideas on big chart paper or on the board. The chart paper provides a permanent record that can be revisited later in the year to check the progress of students' understanding of or thinking about mathematical concepts or skills. At that time, you can revise students' comments or add new ideas.

You can also use the prompts in a problem-solving context where students create a solution in a group or individually. If groups work on the problems, they can share their ideas before the whole class. If they work individually, you will need to find some way to provide for a sharing of ideas. Either way, their ideas should be recorded for future reference.

Number Sense, Properties, Operations with Real Numbers

1. **Solve $4 \cdot 23 \cdot 25$. Describe your process.**

   Solve it another way. Describe that process. Compare the results. What conclusions can you make?

   Students may first solve it in the order written. Another way is to group 4 and 25 together first, to make an easier problem. Or students may multiply 23 and 25 first. Their conclusions will vary depending which methods they elect to use.

2. **Jeremy wrote the following on the board.**

   $$4^2 \times 4 \times 4 \times 4 = 76$$

   Use any operational symbols in the boxes to make the number sentence true. Justify your answer by describing your steps.

A possible solution is $(4^2 + 4) \times 4 - 4 = 76$. Students should relate the solution to the order of operations.

3. **Find two ways to write 64 as a number raised to a power. Justify your answer.**

   Students may consider 2 or 4 as a base such as 2^6 or 4^3. Some may use 2 raised to a power as a base such as $(2^2)^3$. Another response may be 8^2.

4. **An exponent of 4 means . . . Give specific examples to support your explanation.**

   Students should indicate that 4 designates the number of times the base is used as a factor. They should include at least one specific example to support their explanation.

5. **Elise said, "My calculator gave an answer to a problem in scientific notation. Why do we need that notation anyway?" What would you tell Elise? Support your answer.**

   Students usually indicate that it is needed to describe very large or very small numbers. Some may relate it to calculator use or give science examples.

6. **Erica said, "-2^4 is -16." Eric argued, "No, -2^4 is 16." Who do you agree with? Why?**

   Students should agree with Erica and support their answer. Some students may use order of operations to support their answer.

7. $\frac{2}{0} =$

   Marty dropped spaghetti sauce on his math paper. What do you think is under the sauce he dropped? Why?

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Students should indicate that division by 0 is undefined and give a rationale as to why it is undefined.

8. **Rex said the opposite of a number is the same as its additive inverse. Randy said they are not the same. With whom do you agree and why?**

   Agree with Rex. The sum of a number and its additive inverse is 0, which is also true for opposites.

9. **Give four pairs of numbers whose sum is –2. Write the addition sentence for each pair. Describe your process for finding the sum. Do you notice any patterns in the pairs or sentences that you selected?**

   Some responses may indicate patterns related to increasing one addend and decreasing the other to maintain a sum of –2, such as $-3 + 1 = -2$, $-4 + 2 = -2$.

10. **Find four pairs of numbers whose sum is 0. Write the addition sentences for your pairs. What do you notice?**

    Students should notice that the pairs they find are additive inverses. If zero is one of the numbers, then the pair is made up of two zeros.

11. **Find four pairs of numbers whose difference is 0. Write the subtraction sentences. What do you notice?**

    Students should notice that the two numbers are the same regardless of the types of numbers they choose.

12. **The product of two numbers is –36. List all possible pairs of integers that could be factors. What do the pairs have in common?**

Students usually notice that only one factor is negative. The pairs they should include are –1 and 36, 1 and –36, –2 and 18, 2 and –18, –3 and 12, 3 and –12, –4 and 9, 4 and –9, and –6 and 6.

13. Rhonda said $\frac{8}{15} \div \frac{2}{3}$ was solved by dividing 8 by 2 and 15 by 3. Her quotient is $\frac{4}{5}$. Do you agree or disagree with her method? Why?

This prompt will provide some interesting looks at fractional division. New algorithms may be developed.

14. When Steve simplified $(-3)^4$, he got 81. Sharon got –12. Do you agree with either solution? Why or why not?

Agree with Steve. Sharon computed -3×4 rather than using –3 as a factor four times.

15. Place parentheses in the expression to make a true statement. Justify your answer.

$$5 \cdot 2 + 3 \cdot 4 = 22$$

$(5 \cdot 2) + (3 \cdot 4) = 22$. Students should offer some justification.

16. Glen wanted to compute the sales tax on a shirt that cost $21 and a pair of shorts that cost $17. If the tax is 7%, show Glen two ways he could compute the tax correctly. Describe both ways to him.

Students typically use the distributive property to compute. You might want to discuss with the class the different methods they used. Do you get the same answer regardless of the method you use?

17. Martin asked his teacher, "Why do we need exponents?" What do you think Martin's teacher said?

Students may respond that exponents are a shortcut to writing factors multiple times. Others may focus on specific examples such as scientific notation.

18. Find five pairs of numbers whose product is 1. Write the multiplication sentences. What do you notice?

Students should notice that the numbers are reciprocals or multiplicative inverses. The patterns students notice provide good class discussion.

19. April said $4^{-2} \times 4^{0}$ equals 4^{0}. Leigh said it equals 4^{-2}. Do you agree with either student? Why or why not?

Students should agree with Leigh. They may give a variety of reasons, but most frequently they note that 4^{0} is 1, or they use the law of exponents related to multiplying with like bases.

Factors and Multiples

20. A prime number is (or is not) like a composite number because . . .

Students should comment that prime numbers do not have as many factors as composite numbers. They may also mention that there is only one even number that is prime but there are many even numbers that are composite. Other similarities or differences are possible.

21. Write as many different factors as you can for $10x^4$. Is x^0 a factor? Explain.

Students should respond with all the monomial factors: 1, 2, 5, 10, x, x^2, x^3, x^4, $2x$, $5x$, $10x$, $2x^2$, $5x^2$, $10x^2$, $2x^3$, $5x^3$, $10x^3$, $2x^4$, $5x^4$, and $10x^4$. Their discussion of x^0 should be interesting as this represents 1 if x is not 0.

22. Why is two the only even prime number?

After two, all even numbers have two as a factor.

23. Jason said, "All numbers have an even number of factors." "No, they don't," said Brad. "Some special numbers have an odd number of factors." Why would Brad say that? What was he talking about?

Students should mention that square numbers have an odd number of factors. Other composite and prime numbers have an even number of factors.

24. Is $5x^4$ a multiple of $5x^3$? Explain.

It is a multiple. Students should provide a credible explanation or show that $5x^3 \cdot x = 5x^4$.

24. Describe the difference(s) between *factor* as a noun and *factor* as a verb.

Students should provide examples to illustrate the differences or give a good argument to differentiate between the two. Factor *as a noun refers to each number used in a multiplication sense.* Factor *as a verb indicates that one should begin with a product and find the two factors that would multiply to give the product.*

25. Elly asked, "How do I determine if a number is prime?" What would you tell Elly? Use specific examples to justify your response.

Students may use divisibility skills or ideas to explain how Elly can determine if a number is prime. Accept other methods that are appropriate. Be sure that students include at least one specific example to support their response.

26. Give four pairs of integers greater than 1 that are relatively prime. What does it mean to be relatively prime?

Compare students' responses with your class discussion of relatively prime concepts. Encourage students to use more than a book's definition to describe it.

Patterns, Relations, and Functions

1. Describe the pattern in words.

$$-4 \times 1 = -(4 \times 1)$$
$$-4 \times 2 = -(4 \times 2)$$
$$-4 \times 3 = -(4 \times 3)$$

Use variables to describe the pattern in a different way.

Students typically say that the pattern is to multiply one negative number by a positive number and that it is the same as taking the opposite of the product of two positive numbers. Students may describe the pattern in a way quite different from the multiplication of integers. Be open to their descriptions.

2. **Define a function in your own words. Give examples to illustrate your definition.**

   Students will use a variety of ways to define a function. Do not accept book definitions. This is a good prompt to repeat at the end of the chapter or unit on functions.

3. **Reid said, "In the city where I live, the tax rate on purchased items is a function." Describe what Reid meant when he said it was a function.**

   Students' responses should indicate that as the purchase amount increases, taxes also increase and that a purchase amount will have only one tax amount.

4. **Give an example of a relation that is a function. Give an example of a relation that is not a function. Describe how to determine if a relation is a function.**

   A relation is any set of ordered pairs while a function is a special relation in which each first number of an ordered pair has exactly one second number. An example of a relation is {(8, 4), (7, 5), (0, 12) . . .}. A function might be $y = x + 1$.

5. **What does it mean to be a one-to-one function? Give an example of a function that is one-to-one and an example of a function that is not one-to-one. How can you tell the difference between the two?**

   Students should convey the notion that each y in the range of the function is the image of precisely one x in the domain. An example of a one-to-one function is $y = 2x + 9$. A function that is not one-to-one is $y = 5 - 3x^2$.

6. **Describe the relationship of y to x in the following ordered pairs.**

$$\{(-3, -2), (-1, -\tfrac{2}{3}), (1, \tfrac{2}{3}), (3, 2)\}$$

Write an equation to represent the relationship.

Students should represent the relationship with an equation equivalent to $y = (\frac{2}{3})x$. Their first description may be in words or with a graph.

7. **Carrie asked the teacher, "I have a function that takes a number and increases it by 2. When I graph it, I get a line that goes up from left to right. Does every function have a graph that goes up from left to right?" What do you think the teacher said?**

Answers will vary. Students should indicate that a function's graph does not always have a positive slope. It is possible for the line to have a slope of 0 or a negative slope.

Algebraic Expressions

8. **Which is larger, $5n$ or $-5n$? Give examples to support your answer.**

Students should comment that the variable can assume both positive, negative, and zero values. Thus if n is positive, 5n is larger; if n is negative, –5n is larger, and if n is zero, they are equal.

9. Find values for m and n such that mn is equal to 18. Justify your answer.

Students may find that $m = 3$ and $n = 2$, $m = 1$ and $n = 18$, or $m = 36$ and $n = .5$. Other solutions are possible. Look for the use of numbers other than whole numbers.

10. An expression and an equation are alike or different because . . .

An expression is "not equal" to anything. In an algebraic expression, the variable can assume different values. Hence you cannot solve an expression for a specific variable value.

11. Sketch and label a rectangle with perimeter $12x + 8y$. Sketch another rectangle with the same perimeter.

Some students may show a rectangle of sides $3x$ and $2y$; others may show $3x + 2y$ for each side. Other solutions include $6x + 3y$ for two sides and y for the other two sides. There are many possible solutions.

12. Johnny said there were three different pairs of monomials whose sum is $4x^3y$. Do you agree or disagree? Why?

Students should disagree. There are infinite pairs. For example, $x^3y + 3x^3y$, $2.5x^3y + 1.5x^3y$, and so on. Some students may comment on the need for the two monomials to be like terms.

13. Draw and label four different quadrilaterals whose perimeter is $10x + 6y$. Is it possible to find other polygons with that perimeter? Why or why not?

Students should use a variety of quadrilaterals rather than only rectangles. Accept any that have the appropriate perimeter. Make sure they justify their responses.

14. What does it mean to simplify an algebraic expression?

Students may indicate that to simplify an expression is to combine like terms or perform indicated operations. Accept other responses as they are related to your class discussion on simplifying algebraic expressions.

15. Genna said she has a special way to tell when an algebraic expression has been simplified as far as possible. What do you think her method is?

Many students discuss the notion of like terms. There may be other ways that you have discussed in class.

16. Write an algebraic expression with five terms such that when simplified it equals $9x - 5y$. Justify your answer.

Answers will vary. For example, $4x + 3z + 5x - 3z - 5y$ can be simplified to $9x - 5y$. Accept any appropriate algebraic expression with justification. The justification may include a description of how students know what to do when they simplify an expression.

17. Write a monomial of degree 3. Write a monomial of degree 2. Multiply the monomials. What is the degree of the product? What is the relationship of the degree of the monomial to the degree of the product?

The degree of the monomial product is the sum of the degrees of the monomials that are used as factors.

18. Tom said an example of a monomial with degree zero was x. Shay said that an example of a monomial with degree zero was 3. Is either one correct? Describe why you think that person is correct.

Students should side with Shay with a description of why she is correct. Some students may use the textbook definition to prove their point.

19. Find three pairs of monomials whose product is $8x^3y$. What do you notice?

There are multiple solutions. For example, ($2xy$ and $4x^2$), (x^3 and $8y$), and (4^2 and $2xy$) all have products of $8x^3y$. Students should write some observations about the monomials such as that the product of the coefficients is the coefficient of the product or that the sum of the exponents of the factors is the exponent of the product. Accept other appropriate observations.

Equations and Inequalities

20. To solve an equation means . . .

Students should indicate that solving an equation is finding a value for the variable that makes the equation true.

21. Solving an inequality is like (or is unlike) solving an equation because . . .

Some students may indicate a similarity in solution patterns or procedures. Others may focus on the number of solutions.

22. Jennifer found an answer sheet for algebra problems. One problem's solution was

$$x = 4$$

What problem might have this solution? Is your answer unique? Why or why not?

Answers are not unique. Most students will note that equivalent inequalities can be written. For example, $x < 4$, $2x - 8 < 0$.

23. A linear equation is . . .

Students' comments may show different perspectives. For example, some students may focus on the production of a line while others may look at the degree of the equation.

24. I. M. Dizzie is confused about solution sets. Describe to him the difference between the solution set for $4x + 11 = x - 5$ and $4x + 11 < x - 5$.

Responses should indicate one solution for the equation and multiple solutions for the inequality.

25. If the area of a rectangle (A) is represented by the formula $A = lw$ where l is the length and w is the width, how could you represent the length of a rectangle with a formula? Use your formula to find the length of a rectangle if $A = 40\ m^2$ and $w = 2.5\ m$.

Students should indicate a formula equivalent to $l = \frac{A}{w}$. The length of the rectangle with the given area is 16 m.

26. An advantage to using guess-and-test to solve an equation is . . . A disadvantage to using guess-and-test to solve an equation is . . .

Students may comment on the difficulty they have when the solution to an equation is not an integer. If they are working with polynomial equations, guess-and-test may hinder them in finding all possible solutions.

27. Write an inequality with a variable on each side of the inequality sign, whose solution is $f \geq -2$.

Students' responses are good to use the next day as a warm-up. Trade with other groups or individuals and solve to verify the solution.

28. Tamiko said the solution to $9e - 21 > 17e + 3$ was $-3 > e$. Charity disagreed and said the solution was $e > -3$. With whom do you agree and why?

Agree with Tamiko. There should be a rational argument given using either a conceptual approach or an algebraic one.

29. I can determine how many possible solutions a polynomial equation has by . . .

Some students may determine the number of solutions by using the degree of the equation as a parameter. Accept methods that are consistent with your class discussion. Or use this prompt as a way of instigating that class discussion.

30. Write a polynomial equation in standard form for which 0, 4, and –5 are the only solutions. Justify your answer.

Students should give an equation that is equivalent to $x^3 + x^2 - 20x = 0$.

Systems of Equations and Inequalities

31. **Find two different equations that are satisfied by (3, –4). Describe the relationship of the graphs of your equations.**

    The graphs of the equations will intersect at least at (3, –4). Some students may give equations that are equivalent.

32. **Write a short story that illustrates a use for systems of equations or inequalities.**

    Students may need more time for this prompt. Their stories can be shared in class or displayed on a bulletin board.

33. **"Oh, no," said Patrick. "I have a system of equations to solve and I don't know what method to use." Give Patrick some hints on how to decide what solution method to choose.**

    This prompt is also a process prompt. Students may discuss the use of graphs, elimination, guess-and-test, matrices, tables, or other methods you may have discussed in class.

Graphing

34. **Write the equations of three lines whose graphs are parallel lines. Explain to Brenda how you know they are parallel without graphing.**

    Many students use the notion of equal slopes to explain.

35. **The equations of perpendicular lines are the same as or different from parallel lines because . . .**

    Students' responses may focus on surface features of equations or look at the slope aspect. Some students use a graph to explain.

Students' responses may focus on surface features of equations or look at the slope aspect. Some students use a graph to explain. There should be some mention of the difference in slopes: parallel lines have the same slope; perpendicular lines have the reciprocal of the opposite of the slope of one of the lines.

36. Claire said the equation of her line was $y = -(\frac{2}{3})x - 5$. Help her write five facts she can infer from this equation.

Some of the facts may include these: (1) the line will have a negative slope; (2) it will intersect the y-axis at –5; (3) the line will not be in the first quadrant; (4) the x-intercept is –7.5, and (5) it will not pass through the origin.

37. Kenneth said he had three methods for finding the slope of a line. What three methods could he use? How are the methods related?

The methods may include using the right-triangle method on the graph (rise/run), the slope formula, the slope-intercept form of the equation (if known), or using a table of values for x and y.

38. Erin graphed $x + y = 12$ while Tino graphed $xy = 12$. How do their graphs compare? What is similar and what is different?

Some students may actually graph both of them and compare. Others will look at the form of the equations and make assumptions. Students should comment on the linear aspects versus the hyperbolic graph.

39. A large international airport is looking for air traffic controllers. Write a letter of application explaining why your knowledge of graphing should qualify you for the position.

Watch students' responses for the use of coordinates in tracking air traffic.

40. "Zero slope? Undefined slope? Aren't they the same?" asked Naomi. Fay said, "I don't think so, but I'm not sure." What could you add to the discussion?

Students should use a drawing, a table, or a textual argument to convince them they are different. A zero slope refers to a horizontal line; an undefined slope refers to a vertical line.

41. Dillon is a new student in your algebra class. He seems to have difficulty determining which half-plane to shade when graphing an inequality. Give him some of your helpful hints.

Many students use the "substitution" method to determine where to shade; others may indicate some use of the inequality sign.

Operations with Monomials and Polynomials

42. Write a binomial. Square the binomial. Describe your process for squaring the binomial.

This is a process prompt that focuses on students' methods for multiplying binomials. You may find students who have developed shortcuts for squaring binomials.

43. Freda found a piece of someone's homework that showed one monomial in a pair that has a GCF of 8. The monomial on the paper was $16x$. What could the other monomial have been? Find two other pairs of monomials whose GCF is 8. Describe what it means if two monomials have a GCF of 8.

For example, the other monomial could have been $8y$ or $24a$. The other pairs could be $(8, 8x)$, $(24xy, 8b)$, and so on. Students' descriptions of GCF should be mathematically appropriate.

44. Mark found a mathematical brain teaser in a book. It asked, "If you multiply a trinomial times a trinomial, what is the largest number of terms your product could contain? What is the smallest number of terms?" Help Mark solve the problem.

Students should use examples to illustrate their responses. Some students compare it to the products in binomial multiplication. Students should note that if they are multiplying trinomials, the largest number of terms would be nine. The smallest number would be six.

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Affective/Attitudinal Prompts: Algebra

1. **When I am in algebra class, I feel _____ because . . .**

2. **Write a letter to your best friend describing what happens in our algebra class.**

3. **Draw a picture of a mathematician on a typical workday. Describe the work a mathematician does.**

4. **What does a mathematician do for fun?**

5. **I think an algebra student is (or is not) a mathematician because . . .**

6. **I will probably (or probably not) use algebra when I get a job because . . .**

7. **Pick a song that shows how you feel about algebra. Describe why it shows your feelings.**

8. **If I could change one thing about our algebra class, it would be to . . .**

9. **A job that uses a lot of algebra is _____ because . . .**

10. **Using group work in algebra makes me feel . . .**

11. Algebra is . . . How does it compare to arithmetic?

12. Problem solving is . . .

13. Geometry is (or is not) related to algebra because . . .

14. My favorite thing in algebra this year was when . . .

15. My math class last year was the same (or different from) this year's class because . . .

16. My parents (or guardians) did (or did not) like algebra because . . .

17. To be a better algebra student, I need to . . .

18. If I had to solve an equation, I would (or would not) use a calculator because . . .

19. Computers are (or are not) useful in algebra because . . .

20. How could you show that math and science are related?

21. The one tool that is used most to do algebra is the _____ because . . .

22. Draw a picture of a "perfect" algebra student. Describe why the student you chose is perfect.

23. If I could change one thing about myself as an algebra student, it would be . . .

24. Studying algebra is (or is not) important because . . .

25. My feelings about algebra have changed (or have not changed) this year because . . .

26. The perfect algebra textbook would have . . .

27. A mathematician and a scientist are alike (or different) because . . .

28. Algebra is (or is not) the newest mathematical topic because . . .

29. I anticipate making a grade of _____ in algebra because . . .

30. Mathematicians use algebra to . . .

31. I just found out that IBM and Burger King have both hired mathematicians. What do you think a mathematician would do at both companies that would be the same? What would be different ?

Process Prompts: Algebra

1. **I like to describe a pattern using _____ because . . .**

   Students should discuss how they describe patterns. They may indicate they use symbols, words, or pictures. Other methods may be described as well.

2. **Justin is trying to decide what would be a good method to use to solve an equation. Describe your method using any equation you want.**

   Students' responses should include an equation along with the method used to solve it. Be sure to check the method for accuracy and applicability across a wide range of equations.

3. **My favorite method of solving polynomial equations is _____. An example of this is . . .**

   Students' responses should include a specific equation, with degree two or higher. Their methods may include graphing, using the quadratic formula, factoring, using guess-and-test, and others.

4. **Studying for an algebra test is the same as (or different from) studying for an algebra quiz because . . .**

   Students may indicate that there is no difference or they may discuss the point value of tests versus quizzes. Some students think that tests are more comprehensive than quizzes.

5. **Kevin said, "There's a secret to being able to solve a word problem." What do you think Kevin's secret could be? Explain.**

If you notice students referring to a key word approach, you may want to discuss the pitfalls of using it. Students may describe other processes they use to solve word problems that would be helpful to others. Encourage a class discussion.

6. **When I see a word problem, I first _____. Then I . . .**

   Students' responses will give you insight into the processes they use when they confront a word problem, either nonroutine or algorithmic.

7. **To help me understand how to do operations with polynomials, I would change my algebra book so that . . .**

   The changes students describe can be used as you plan your lessons about polynomial operations.

8. **When I need to simplify an expression, I think . . .**

   Students should describe the process they use for simplifying expressions.

9. **I can justify my solution to an equation by . . .**

   Students' explanations should be mathematically appropriate. Some students use substitution as a way to check the equation's solution.

10. **To factor a trinomial, I must consider . . .**

    Responses will give you insight into students' development of generalizations related to factoring trinomials. You will be able to detect their processes for factoring.

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11. When I compare the size of two integers, I think . . .

You may see the mention of placement on a number line or absolute value. Other methods are possible.

12. Problem-solving strategies help me in algebra because . . .

This prompt is useful in helping students understand how nonroutine problems are linked with algebra. You may see students' responses that mention guess-and-test, making a table, looking for patterns, and writing an equation.

13. When I read my algebra book, I . . .

Algebra books often contain problems that students can solve as they read. Encourage them to always read with a pencil and paper handy so they can solve problems before they read on. If you detect that students do not use content reading skills, you may want to do structured reading with your class. This will help them learn how to read a mathematics book.

14. The thing I understand the most in algebra is _____ because . . .

This prompt can be used at the end of each chapter or unit. Students can share the things they are most comfortable with.

15. Before I begin to solve an equation, I first . . .

Students' responses can be shared with the class. You will especially want to emphasize strategies that involve considering the parameters of solutions. Or some students may mention that they first think how this equation is similar to others they have solved.

16. The problem-solving strategy I use the most is _____ because . . .

Students will share the strategy they use the most. You may want to watch for that particular strategy in class discussions.

17. Describe how you remember the order of operations.

Students often describe a mnemonic device such as Please Excuse My Dear Aunt Sally (PEMDAS).

18. Before I start graphing an equation, I must first think about . . .

Students should use "graph" sense by thinking about whether the line will have a positive slope or a negative slope, the intersection points on the x- and y-axes, and the general shape of the graph.

19. Learning algebra is easier when I . . .

Students describe what helps them learn in this prompt. You may be able to use some of their responses in a class discussion.

20. Learning algebra is the same as (or different from) learning history because . . .

Students make connections with regard to the learning aspect in two subjects.

21. The most important thing to learn in algebra is . . .

Students share what they view as the most important concept or skill. It will be interesting to note if they also share instructional components, such as working in a group.

22. To help me understand how to do operations with polynomials, I would change my algebra book so that . . .

Students' responses may give insight into techniques that could be used in your instruction.

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